The world of energy is changing rapidly and will continue to do so in the future. The conventional system of electricity being produced in bulk by large facilities is changing to system where electricity is produced in a more distributed matter in smaller amounts, closer to where it is consumed. This results in the power flow changing from being unidirectional from power plants to consumers to being bidirectional, with a flow ‘upstream’ during periods of high RES feed-in in certain areas. On the other hand, we see an ever increasing use of electrical appliances replacing others running on fossil fuels such as electric heating systems and electric cars. This electrification of society together with the change to distributed generation (DG) poses major challenges within the construction, maintenance and operation of the electricity grid.

To tackle these challenges the energy systems have to be ‘smarten’. This comes in the form of information and communication technologies on all levels in the grid, from a “smart” device in households to improved forecasting and modelling on national or even international levels of the grid but also with a more active involvement of the users of the system. In this talk an overview of the resulting challenges and possible solution directions is given. For concrete projects and corresponding publications see <https://www.utwente.nl/en/eemcs/energy/> .